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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
JUNG, UNSU	

ART UNIT	PAPER NUMBER
1641	

DATE MAILED: 07/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/809,318	DENES ET AL.	
	Examiner	Art Unit	
	Unsu Jung	1641	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 May 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) *18-33* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 March 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *8/16/04 & 11/23/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-33 are pending.

Election/Restrictions

2. Applicant's election with traverse of Group I (claims 1-17) in the reply filed on May 25, 2006 is acknowledged. The traversal is on the ground(s) that the method claims of Groups I and III are so closely related that the two sets of claims should not require separate fields of search. Applicant further argues that the extremely close relationship between the method claims is illustrated by the fact that certain steps recited in independent method claim 1 are also recited in independent method claim 27 and that other steps in the methods are correspondingly similar. This is not found persuasive because Inventions I and III are independent and patentably distinct as discussed in the Office Action dated February 27, 2006. The method of Group I includes a step of forming hydroxyl groups on an oxide surface by exposing the surface to a plasma, which is not required by the method of Group III. The method of Group III includes a step of implanting silicon-chlorine functionalities into the substrate surface by exposing the surface to a chlorine-containing plasma, which is not required by the method of Group I. Therefore, the methods of Groups I and III have different modes of operation and are patentably distinct. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Furthermore, because the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper. While searches would be expected to overlap, there is no reason to expect the searches to be coextensive.

The requirement is still deemed proper and is therefore made FINAL.

Information Disclosure Statement

3. The information disclosure statement (IDS) submitted on August 16, 2004 and November 23, 2005 have considered by the examiner. However, the references of IDS submitted on August 16, 2004 contain following errors and should be corrected as indicated on the IDS.

- Cheung et al.: publication year (2003), journal name (Langmuir), volume number (Vol. 19) and page number (pp5846-5850) should be included
- "Motorola's Biochip Center Aims for a Healthier World": author name (Quan), journal name (EE Times), and publication date (Feb. 16, 1999) should be included
- http://www/whatis.com/biochip.html: title (Biochip) should be included
- http://arrayit/com/Products/Substrates: title (Microarray Substrates & Slides) should be included
- http://arrayit.com/Products/Substrates/SME/sme.html: title (SuperEpoxy Substrates") should be included
- http://www.vwrcanlab.com: period after "http" should be corrected to a colon and a publication date should be included

Drawings

4. The drawings are objected to because:

- reference number 77 in Fig. 3 is used to identify two different structures (one of the reference number 77 on the right side of the diagram should be corrected to 67 as it points to the mechanical support bearing, which is symmetrical to the other mechanical support bearing indicated by reference element 66, p10, paragraph [0037]);
- reference number 76 in Fig. 3 is defined by two different terms (containers and source cylinder, p11, paragraph [0038], lines 1-2); and
- reference number 77 in Fig. 3 is defined by three different terms (needle valves, pressure regulators, and control valves, p11, paragraph [0038], lines 2-4).

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an

application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

5. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: 67 in Fig. 3. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1-17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

8. In claim 1, the term "the surface" in lines 3-4 is vague and indefinite. It is unclear whether the term "the surface" in lines 3-4 is referring to "a surface" in line 1 or "an oxide surface" in line 3. For the purpose of examination, all three terms "a surface", "an oxide surface", and "the surface" have been interpreted as being the same.

9. In claim 2, the term "the surface" in lines 2 is vague and indefinite. It is unclear whether the term "the surface" in lines 3-4 is referring to "a surface" in line 1 of claim 1 or "an oxide surface" in line 3 of claim 1. For the purpose of examination, all three terms "a surface", "an oxide surface", and "the surface" have been interpreted as being the same.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

12. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

13. Claims 1-8, 13, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) in view of Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) and Schössler et al. (U.S. Patent No. 4,822,681, April 18, 1989).

Wagner et al. teaches methods and devices for parallel, in vitro screening of biomolecular activity using miniaturized microfabricated devices. The biomolecules

immobilized on the surface of the devices include proteins (Abstract) and polynucleotides (oligonucleotide, p3, paragraph [0039]). The reactive site of the device may comprise a coating between a substrate and its organic thin film. This coating can be formed on the substrate by plasma exposure, which can be used directly to activate the substrate to expose polar functionalities such as hydroxyl groups (step (a), p8, paragraph [0092]) and the substrate may be either organic or inorganic and may comprise a material selected from a group consisting of silicon silica, quartz, glass, carbon, titanium dioxide, etc. (p6, paragraph [0075]). Deposition or formation of the coating on the substrate must occur prior to the formation of organic thin films (p8, paragraph [0097]). A variety of different organic thin films are suitable including molecules of the formula X-R-Y where R is a spacer, X is a functional group that binds R to the surface, and Y is a functional group for binding proteins onto the monolayer (p8, paragraph [0099]). X group may be chosen as any group, which affords chemisorption or physisorption of the monolayer onto the surface of the substrate (p9, paragraph [0103]). Methods for the formation of organic thin films include *in situ* growth from the surface, deposition by physisorption, spin-coating, chemisorption, self-assembly, or plasma-initiated polymerization from gas phase [p8, paragraph [0099]). However, Wagner et al. fails to teach a step of reacting a first gas comprising epoxy-functional molecules with the surface hydroxyl groups in situ in the absence of plasma to provide surface-bound spacer chains.

Hubbell et al. teaches that functional groups such as epoxy can interact with amine, hydroxyl, or thiol groups (p6, paragraph [0058]).

Schössler et al. teaches a method of reacting hydroxyl-group-containing solid body surfaces with glycidoxypropyltriethoxysilane (column 4, lines 26-29). With this variation, the biological materials to be bound react directly with the epoxy-groups of the solid body surface (column 4, lines 29-31). Herewith it is important that the reaction with the organosilanes, which are non-toxic and are produced to considerable extent on a large scale, be effected by simple contact or immersion, with the activation taking place in swollen or non-swollen state of the solid body, or even in the gaseous phase (column 4, lines 31-36). It is of greater importance herewith that the reaction with organosilanes can follow in liquid phase with organic solvents, such as acetone, toluene, dioxane, methanol, ethanol, among others, solvent mixtures such as methanol/ethanol, as well as in aqueous milieu or water/solvent mixtures, such as methanol/water or ethanol/water, so that in contrast to many other activation techniques, the technological expenditure is lower (column 4, lines 36-44). It is particularly advantageous to effect the activation in gaseous phase through employment of aerosols or by means of underpressure (column 4, lines 44-47).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to include in the method of Wagner et al. with a spacer molecule X-R-Y, wherein X is an epoxy functional group as taught by Hubbell et al., in order to bind the spacer molecule to a substrate surface of Wagner et al. with hydroxyl groups as Wagner et al. teaches that the X group may be chosen as any group, which affords chemisorption or physisorption of the monolayer onto the surface of the substrate. In addition, it would have been obvious to one of ordinary skill in the art at the time of the

invention to employ a method of reacting a gas comprising spacer molecules with epoxy functional groups with the surface hydroxyl groups in situ in the absence of plasma as taught by Schössler et al. as activation in gaseous phase through employment of aerosols or by means of underpressure provides an activation technique, which has lower expenditure compared to other activation techniques. The advantage of employing an activation technique with lower cost provides the motivation for combining the teachings of Wagner et al., Hubbell et al., and Schössler et al. with a reasonable expectation of success as Wagner et al. teaches that monolayer can be formed comprising spacer molecules in gaseous phase.

With respect to claim 2, Wagner et al. teaches a method further comprising immobilizing biomolecules on the surface by reacting the biomolecules with surface-bound spacer chains (p9, paragraph [0112]).

With respect to claim 3, Wagner et al. teaches a method, wherein the biomolecules are amine-functionalized or amine-containing biomolecules (p12, paragraph [0135]).

With respect to claim 4, Wagner et al. teaches a method, wherein the oxide surface comprises a silicon oxide (p6, paragraph [0075] and p9, paragraph [0104]).

With respect to claim 5, Wagner et al. teaches a method, wherein the oxide surface comprises silica, glass, or quartz (p6, paragraph [0075]).

With respect to claim 6, Wagner et al. teaches a method, wherein the oxide surface comprises a metal oxide (p6, paragraph [0075]).

With respect to claim 7, the current specification teaches that native oxides of stainless steel includes chromium oxide and iron oxide (p18, paragraph [0060]). Wagner et al. teaches a method, wherein the metal oxide comprises chromium and iron oxides (p8, paragraph [0093]). Since Wagner et al. teaches that multiple interlayers may be used together (p4, paragraph [0057]), the substrate of Wagner combined with an interlayer of metal oxide comprising chromium oxide or iron oxide is interpreted as being the currently recited substrate.

With respect to claim 8, Wagner et al. fails to specifically teach a method, wherein the plasma is formed from a source gas comprising water, oxygen, or a mixture thereof. Hubbell et al. teaches a method, wherein the plasma is formed from a source of gas comprising water in order to increase the number of hydroxyl groups at the oxide surface (p14, paragraph [212]), wherein the oxide surface includes stainless steel (p12, paragraph [0178]). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to include the plasma formed on the native oxide of stainless steel from a source of gas comprising water as taught by Hubbell et al. in the method of Wagner et al. in order to form hydroxyl groups on metal oxides.

With respect to claim 13, Wagner et al. teaches a method, wherein the biomolecule is oligonucleotides (p3, paragraph [0039]).

With respect to claim 14, Wagner et al. teaches a method, wherein the biomolecule is a protein (p3, paragraph [0038]).

14. Claims 9 and 10 are 35 U.S.C. 103(a) as being unpatentable over Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) in view of Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) and Schössler et al. (U.S. Patent No. 4,822,681, April 18, 1989) as applied to claim 1 above, and further in view of Laibinis et al. (WO 01/83826 A2, Nov. 8, 2001).

Wagner et al. in view of Hubbell et al. and Schössler et al. teaches a method of treating a surface of a substrate as discussed above. However, Wagner et al. in view of Hubbell et al. and Schössler et al. fails to teach a method, wherein the epoxy-functional molecules are epichlorohydrin molecules.

Laibinis et al. teaches that epichlorohydrin reacts with hydroxyl moiety of a glass (substrate surface) to provide a surface having epoxide functional groups (p19, lines 14-17).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to employ epichlorohydrin, which contains epoxy functional groups as taught by Laibinis et al. in the method of Wagner et al. in view of Hubbell et al. and Schössler et al. in order to react with hydroxyl groups of oxide surface. The advantage of providing a surface having epoxy functional groups, which can be used to immobilize biological molecules, provides the motivation to combine the teachings of by Laibinis et al. and Wagner et al. in view of Hubbell et al. and Schössler et al. with a reasonable expectation of success as epoxy functional groups of epichlorohydrin can be used to react with hydroxyl groups of the oxide surface to functionalize the surface for immobilizing biomolecules.

15. Claims 11 and 12 are 35 U.S.C. 103(a) as being unpatentable over Wagner et al. (U.S. PG Pub. No. US 2002/0110932, Aug. 15, 2002) in view of Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) and Schössler et al. (U.S. Patent No. 4,822,681, April 18, 1989) as applied to claim 1 above, and further in view of Devoe et al. (WO 01/96452 A2, Dec. 20, 2001).

Wagner et al. in view of Hubbell et al. and Schössler et al. teaches a method of treating a surface of a substrate as discussed above. However, Wagner et al. in view of Hubbell et al. and Schössler et al. fails to teach a method, wherein the epoxy-functional molecules are 1,4-butanediol diglycidyl ether molecules.

Devoe et al. teaches that numerous commercially available epoxy resins including 1,4-butanediol diglycidyl ether can be used apply on a solid surface (Abstract and p13, line 12).

Therefore, it would have been obvious matter of design choice to modify the Wagner et al. in view of Hubbell et al. and Schössler et al. to include 1,4-butanediol diglycidyl ether of Devoe et al. as epoxy-functional molecules, since Applicant has not disclosed that 1,4-butanediol diglycidyl ether does not solve any stated problem or is for any particular purpose and it appears that using 1,4-butanediol diglycidyl ether would provide a functionalized substrate surface for immobilization of biomolecules with a reasonable expectation of success as epoxy functional groups of 1,4-butanediol diglycidyl ether can be used to react with hydroxyl groups of the oxide surface to functionalize the surface for immobilizing biomolecules.

16. Claims 15-17 are 35 U.S.C. 103(a) as being unpatentable over Wagner et al. (U.S. Patent No. PG Pub. No. US 2002/0110932, Aug. 15, 2002) in view of Hubbell et al. (U.S. PG Pub. No. US 2002/0128234, Sept. 12, 2002) and Schössler et al. (U.S. Patent No. 4,822,681, April 18, 1989) as applied to claim 1 above, and further in view of Dang et al. (U.S. PG Pub. No. 2003/0113478, Filed Dec. 12, 2001).

Wagner et al. in view of Hubbell et al. and Schössler et al. teaches a method of treating a surface of a substrate for immobilization of biomolecules as discussed above. However, Wagner et al. in view of Hubbell et al. and Schössler et al. fails to teach a method, further comprising extending the spacer chains by reacting the spacer chains with spacer molecules in situ in the absence of plasma to provide extended spacer chains, wherein the spacer molecules comprise an amine group capable of reacting with epoxy functionality of the spacer chains.

Dang et al. teaches a method of forming a coating on a substrate with a surface-modifying group, which can further react with a biologically active component resulting in a substrate with an immobilized bioactive agents such as nucleic acids and proteins (p2, paragraph [0026] and p6, paragraph [0084]). Dang et al. further teaches that it may be desirable to place one or more additional compounds as a multi-functional linker between chemically functional groups and bioactive agents to increase space between the substrate layer and the bioactive agents or to reduce undesirable responses such as steric hindrances between the functional group and the immobilized bioactive/biocompatible agents, which may limit the approach of the

bioactive/biocompatible agent to the functional group, and physical bulk, electrostatic repulsion, or inappropriate positioning of the bioactive/biocompatible agent or agents, which may also contribute to reduced efficiency of the immobilized bioactive/biocompatible agent or agents (p5, paragraph [0077]). Suitable compounds for use as multi-functional linkers include epoxies and amines and can be heterofunctional or homofunctional (p5, paragraph [0078]). The available functional groups or surface-modifying groups are used to covalently or non-covalently bind the bioactive agent possessing desirable properties to substrate (p5, paragraph [0080]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to employ an additional spacer molecule (X-R-Y) as taught by Dang et al. in the method of Wagner et al. in view of Hubbell et al. and Schössler et al. in order to increase space between the substrate layer and the bioactive agents or to reduce undesirable responses and immobilize bioactive agents such as nucleic acids and proteins via covalently interaction with surface-modifying groups, wherein the functional group of the additional spacer molecule includes amine group as Hubbell et al. teaches that functional groups such as epoxy can interact with amine groups . The advantage of reducing undesirable responses such as steric hindrances between the functional group and the immobilized bioactive/biocompatible agents, which may limit the approach of the bioactive/biocompatible agent to the functional group, and physical bulk, electrostatic repulsion, or inappropriate positioning of the bioactive/biocompatible agent or agents, which may also contribute to reduced efficiency of the immobilized bioactive/biocompatible agent or agents provides the motivation to combine the

teachings of Dang et al. and Wagner et al. in view of Hubbell et al. and Schössler et al. with a reasonable expectation of success as one of ordinary skill in the art would recognize that additional spacer molecules would provide more efficient immobilization of biomolecules to the functionalized surface of the substrate.

Conclusion

17. No claim is allowed.

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Unsu Jung whose telephone number is 571-272-8506. The examiner can normally be reached on M-F: 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Long Le can be reached on 571-272-0823. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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